Does the Value Circle Exist within Persons or Only Across Persons?

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To appear in *Journal of Personality*

Abstract

Objective: To test whether the Schwartz (1992) value circle exists within individuals, not only across individuals, thereby providing evidence for the within-person rationale underlying the value circle.

Method: We analyze responses from five samples (a representative sample in Britain, a general population sample in the USA, and university students in Britain and Iran) varying in value measures of the Schwartz value theory (SVS, PVQ40, PVQ21). An unfolding model is used to map each person's value profile into a 2-dimensional space representing both persons and values.

Results: In all samples, clear value circles were found, with values ordered around the circle largely according to the theory. The model also represents most individuals well.

Conclusions: The value circle exists within individuals, providing strong support for the underlying within-person rationale for the Schwartz (1992) value theory. The unfolding analysis allows identifying which persons fit the model less well and in which way, identifying how meaningful sub-groups differ in their value profiles, and testing whether meaningful sub-groups have different value structures. The model opens up many new possibilities for research linking values to other variables.

KEYWORDS: Values, Value Structure, Value Circle, Unfolding, Circular Scale

Numerous studies, spanning different populations and cultures, have established the structure of personal values (e.g., Schwartz, in press). Values are structured in a *circle* of conflicts and compatibilities, such that adjacent values in the circle are theoretically compatible and empirically positively related, and values on opposite sides of the circle are theoretically conflicting and empirically negatively related.[1] The rationale that underlies the theoretical structure is based on the idea that, for any individual, holding conflicting values with high priority is likely to be difficult partly because pursuing one value often leads to consequences that violate the conflicting value. In contrast, holding adjacent values with high priority is likely to be easy partly because adjacent values can often be pursued simultaneously in the same action.

The most appropriate way to examine such an assumption is to test whether the circular value structure exists within individuals, because the proposed conflicts and compatibilities among values should occur within each individual. Yet the intra-person structure of values has received almost no attention. This paper addresses this crucial gap in the literature by examining the structure of values within persons, using different populations, cultures, and value questionnaires.

Values and their Structure

Values (e.g., achievement, security) convey broad goals that serve as guiding principles in a person's life (e.g., Rokeach, 1973; Schwartz, 1992). Values are quite stable, transcending specific actions and situations, and they are ordered by importance relative to one another. It is this relative importance of multiple values that guides perception and action.

The most studied and established value theory to date is the Schwartz (1992) value theory. Schwartz defined 10 basic values according to the motivational goals underlying them.

[1] When value ratings are controlled for individual response tendency.

Schwartz argued that the relations among values are determined by practical and psychological conflicts and compatibilities. According to Schwartz, values are compatible if they guide similar perceptions, preferences, and behaviors. For example, self-direction and stimulation values are compatible because both guide a preference for new experiences. Values are conflicting if they guide opposing perceptions, preferences, and behaviors, or if the pursuit of one value prevents the pursuit of the other value. For example, pursuing security values by avoiding risks necessarily prevents the pursuit of new experiences expressed in self-direction and stimulation values. Hence, prioritizing conflicting values is likely to produce recurring internal conflicts and difficulty in making decisions. As a result, the more individuals value security, for example, the less they tend to value self-direction and stimulation. And the more individuals value self-direction, the more they tend to value stimulation.

Each of the values in the theory is compatible with some values and conflicts with other values. Hence, if a sample of individuals rates the importance of the value items, the pattern of correlations among all items can be visualized by the circle of wedge-like regions shown in Figure 1. Each region in this value circle includes items that measure the same value, such as stimulation or security. Reflecting the incompatibility of simultaneously pursuing stimulation and security, the regions containing stimulation items and security items, respectively, are situated in opposition to one another in the circle in Figure 1. This pattern has been found primarily by using multi-dimensional scaling (MDS) and it has been established in numerous studies, with samples from many different countries and using a variety of questionnaires (e.g., Döring, Blauensteiner, Aryus, Droegekamp, & Bilsky, 2010; Lee, Soutar, & Louviere, 2008; Schwartz, 1992; Schwartz, Lehmann, & Roccas, 1999).

If one summarizes the various value items that measure each value into a value index, one can condense the ten regions of Figure 1 into ten points that represent the ten basic values. This turns the circle of value regions into a circle of value points (cf. Bardi, Lee, Hofmann-Towfigh, & Soutar, 2009; Cohrs, Moschner, Maes, & Kielmann, 2005). The only point not on the circle is conformity: Just like the region that it represents, this point is shifted somewhat towards the circle's center. Recently, however, Schwartz (2012b) also portrayed conformity in a position between tradition and security, a location also entertained originally in Schwartz (1992). This finding is obtained across individuals. But the theoretical rationale for the value structure pertains to conflicts and compatibilities among values within each individual. Hence, to fully support the Schwartz (1992) value theory, a within-person examination of the structure of values is needed.

Examining the Structure of Values within Persons

There has been one recent attempt to examine the structure of values within individuals (Gollan & Witte, 2014). To do this, the authors assumed that the value circle is like a necklace of pearls with values ordered as power--achievement--hedonism-stimulation--self-direction--universalism--benevolence--tradition--conformity--security--power. In this structure, when one moves from any point (i.e., value) to its neighboring points, the distances to the start point grow monotonically until one reaches its opposing point. Then, moving on in the same direction, the distances to the start point on the way back shrink monotonically until one is back at the start. Therefore, if a particular value is a person's most preferred value, and if the values are arrayed in a certain order on such a conceptual necklace, this person's preference ratings for the other values should exhibit the value order described above. Hence, once the most-preferred value is

known, it should be possible to perfectly predict the rank order of the person's ratings of the other values up to the value most opposed to the preferred value.

This methodological approach, however, provides only a partial answer at best to the research question. Simulations[2] reveal that if we know that a certain value is the most preferred and another value is the least preferred, and all other values receive random ranks, then the expected rank-order correlation is .49 (with *SD* = .19). Even if we know the two values most important for the person (without knowing which is first and which is second) and also the two values least important for the person (without knowing their order), and all other values have random ranks, the expected rank-order correlation is .78 (*SD* = .09). Gollan and Witte (2014) obtained correlations between .54 and .64 in their samples. Thus, their finding only supports the idea that many individuals have opposing values (or pairs of values), but it does not establish that the ten values form a circle within persons.

We examine the structure of values within persons with a different approach that has several strengths. First, it is not limited to testing a particular value structure. Instead, it allows the data to exhibit value circles, *if they exist*, but also other patterns that may represent the data more precisely. Second, our approach allows computing fit indices of the model for any assumed scale level of the data (ratio, interval, or ordinal), without throwing away possible metric information in the data. Third, our approach allows evaluating the model's robustness statistically. Fourth, it allows individuals to rate all values as equally important and still fit into

2 Let **x** and **y** be vectors, each with values 1 to 10. The simulations first generate **y**' by randomly permuting elements 2 to 9 (or 1 to 2, 3 to 8, and 9 to 10, respectively) in **y**, and then compute the Spearman rank correlation *r* of **x** and **y**'. This is repeated many times. Finally, the mean observed *r* and its standard deviation are reported.

the value circle. Finally, it allows identifying individuals who do not fit into the model, and identifying in what way they do not fit.

The theoretical model derives from Coombs's (1964) unfolding theory of preferential choice. Our model begins with the idea that the conflicts and compatibilities among the ten basic values *exist in the same way within individuals*, and individuals only differ in which values they prefer. Expressed more formally, the model claims that all individuals (in a particular sample or in general) share the same 2-dimensional psychological map of values where the different values can be represented as points on a circle. The order of the values on this circle is *predicted* (but not constrained) to reflect the Schwartz value theory (Schwartz, 1992, 2012a). When asked to rate the importance of the ten values, each person naturally finds his or her position relative to the common value circle. This position is the single point whose distances to the value points reflect the importance the person attributes to each of the ten values. Values that are close to a person's point in the model are prioritized by him or her, and values that are distant are less prioritized.

This model does not suggest that an individual literally computes distances on a map, nor does it claim that the map itself is consciously perceived by the individuals. The common psychological map represents a hypothesized latent structure of which individuals are not necessarily aware but that nevertheless guides their value priorities.

In Coombs's (1964) unfolding model, person points are called *ideal points*, as they represent the person's ideal combination of the attributes that span the space of the choice objects. In the case of values, a person point represents the particular profile of value priorities that is preferred to any other profile by this person. This combination is not truly ideal, because the possibility of fully satisfying all values at the same time is *impossible* in the value circle.

Rather, a person point represents the person's individual solution to making choices among *conflicting* values. This involves compromises and tradeoffs. If the person feels that a certain value is exceptionally important, then the theoretical argument is that values opposed to this value cannot also be rated as exceptionally important.

The general hypothesis is that the relative importance ratings of the values can be represented by the distances among each person's point in the psychological map and the points for the values. Moreover, the value points are expected to form a circular structure as predicted by theory and as empirically established by hundreds of correlation-based MDS studies. Persons who consider all values as equally important should lie at the center of the value circle. If they prefer some values over other values, they should be located relatively close to the preferred value points. Thus, our hypotheses are that for any sample of persons and any relative ratings of importance of values:

H1: Persons and values can be represented by points in the same 2-dimensional Euclidean space such that the distances from each person point to the value points correspond to the observed ratings of importance given to the values by the respective person.

H2: The value points form a circular structure that corresponds to the Schwartz (1992) value circle.

Confirmation of these two hypotheses would mean that the value circle exists within persons.

Analytical strategy

Centering value scores. The summative rating scores of the ten basic values are centered on the personal mean of values for each individual. Schwartz (2003, p. 275) argues that it is "critical to correct for individual differences in use of the response scale. It is the tradeoffs between relevant values that influence behavior and attitudes, so it is the relative importance of

the ten values to an individual that should be measured". Empirically, the associations of centered value scores with attitudes, behavior and socio-demographic variables are consistently more logical and meaningful theoretically than the associations of non-centered scores (cf. Schwartz, 2006b). Hence, centering has become the usual procedure in value research (Bardi, Buchanan, Goodwin, Slabu, & Robinson, 2014). The value scores are only centered, however, and not standardized as the assumption is "that differences in the distribution of responses are real. They reflect differences in the extent to which individuals discriminate among their values" (Schwartz, 2003, p. 275).

Testing if correlation-based MDS analyses show the typical circle of values. We use ordinal MDS to first examine to what extent our samples replicate the usual correlation-based value circle found in so many studies. In addition, we use spherical ordinal MDS to enforce configurations where all value points lie on perfect circles.

Converting value indexes to dissimilarities. For unfolding, the importance ratings need to be reversed to turn them into distance-like scores or *dissimilarities* (denoted as δ_{ij}). The dissimilarity δ_{ij} expresses *how far* person *i* considers herself from value *j*. The conversion is done by subtracting each preference score from a constant such that the largest value score is turned into a dissimilarity of zero.

Unfolding analysis. Unfolding refers both to the theoretical model of generating preference judgments among options mentioned above and to the statistical analysis used to test it. The data are comprised of a persons-by-values matrix of value scores converted into dissimilarities. This matrix has the order $n_p \times n_v$ (were p denotes persons and v denotes values), i.e. one row of n_v dissimilarity scores, δ_{ij}, for each of the n_p persons. In our case, $n_v = 10$ for each person, because we have ten basic values. We aim to optimally represent (using the function

"smacofRect" in the R-package "smacof" by De Leeuw & Mair, 2009; R Development Core Team, 2015) each dissimilarity score δ_{ij} by the distance d_{ij} between a point for person i and a point for value j in a 2-dimensional configuration. The configuration we seek should minimize (raw) Stress,

(1) $$\sigma = \sum_{i=1}^{n_p} \sum_{j=1}^{n_v} (\delta_{ij} - d_{ij})^2 \ .$$

The distance d_{ij} between person point i and value point j is computed as

(2) $$d_{ij} = \sqrt{\sum_{a=1}^{2} (x_{pia} - x_{vja})^2} \ ,$$

where x_{pia} is the coordinate of the point representing person i on dimension a, and x_{vja} is the coordinate of the point representing value j on dimension a. So, for example, if we have dissimilarity scores of 350 persons on the 10 basic values, we aim to optimally represent them by 3,500 distances among 350 person points and 10 value points in 2-dimensional Euclidean space. Note that the unfolding approach we use does not proceed in a step-wise fashion that begins with a regular correlation-based MDS of the 10 values and then fits each person into the value configuration found by MDS (*external* unfolding). Rather, we use *internal* unfolding that *simultaneously* places all value points *and* all person points into the solution space without relying on correlations. Thus, the structure of the value points does not necessarily form the expected circle for formal reasons. Rather, it generates a circle only if that is the configuration that optimizes the fit of the unfolding solution to the data.

To make σ in (1) comparable over different data sets and over different configurations, we normalize it to

(3) $$Stress_n = \sqrt{\sigma / \sum d_{ij}^2} \ .$$

Stress$_n$ resembles the *Stress-1* coefficient used in multidimensional scaling (Borg & Groenen, 2005). It varies between 0 and 1. Perfect solutions have a Stress value of zero. Non-perfect solutions have Stress values greater than 0. However, statistical benchmarks derived within the MDS context for what is considered high, low, or acceptably low cannot be used directly in unfolding because of its special data structure (i.e., having both persons and objects represented in the same space). We therefore generate statistical norms by simulating the fit of random data and of random permutations of the observed data.

We also assess how much each variable contributes to the overall fit criterion σ in (1). This information is given by the Stress-per-Point coefficient (SPP), which is the sum of squares of (1) for a fixed *j* relative to the total σ (Borg, Groenen, and Mair, 2012). The SPP coefficients show, in particular, if particular values should be considered outliers in the model.

We also measure how well individuals fit into an unfolding solution by computing the alienation coefficient *K* of their dissimilarities and the distances from their person points to the value points. *K* is equal to $\sqrt{1-c^2}$, where *c* is Tucker's congruence coefficient, the correlation coefficient for non-centered variables[3]. Using computer simulations, we determine the expected (mean) *K* and the 5% quantile of *K* for random dissimilarities under 2-dimensional metric unfolding. An observed *K* that is smaller than this 5% value can be considered significant.

Technically, unfolding algorithms can easily degenerate to solutions with very small Stress but poor data representation. For example, if all persons were positioned at the center of a

[3] This is the proper correlation for variables with a fixed origin. Since congruence coefficients tend to be numerically close to 1 for non-negative data with a fixed origin (such as distances and dissimilarities), *K* is often used because it of its better interpretability in this context (Borg & Groenen, 2005).

circle of points that represent the values, then the Stress value is zero, whatever the dissimilarities, provided that the data are at most on an interval scale. To avoid such meaningless solutions, one must either assume that the data are on a ratio scale (where adding any non-zero constant *k* is inadmissible as it changes the meaning of the scores) or one must implement computing strategies that systematically avoid degenerate solutions (see, for example, Borg & Groenen, 2005, chapter 15). For theoretical reasons, we follow Schwartz (2003), assuming that the dissimilarities are on a ratio scale, but we also check this scale level assumption by comparing our solutions to those generated by algorithms based on weaker assumptions. Note that assuming a ratio scale means that we are testing a strong theory: The data should be equal to the distances of the unfolding solution, except for an overall scaling factor of the solution. Thus, for example, if a person exhibits a dissimilarity score of 1 for one value, and a score of 3 for another value, then the corresponding distances from his or her person point to the value points for these values must have the same 1:3 ratio.

Study 1

To establish our hypotheses, we start with a sample that is likely to have the typical value structure across individuals. Many studies on values are based on a student population in a Western country, often finding a perfect value circle. Hence, we start with a student sample in the United Kingdom.

Method

Participants and procedure. The sample consists of 327 undergraduate psychology students in Britain who participated for extra course credit. The questionnaire was administered online followed by other questionnaires that were not used in the current investigation. The age

of the participants ranged from 18 to 51 (M = 20.55, SD = 4.43). Most participants were female (81.34%), reflecting the typical gender distribution in psychology departments.

Instrument. Most previous research on the Schwartz (1992) value theory used the Schwartz Value Survey (SVS) to measure values. The most recent version of the SVS (Schwartz, Sagiv, & Boehnke, 2000) is comprised of 57 items, of which 45 items are used for analyses as they have been found to have equivalent meaning across cultures. Each item is an indicator of one of the basic values. Participants are asked to assess each value (e.g., "PLEASURE (gratification of desires)") as a guiding principle in their life on a scale from 0 (*not important*) to 7 (*of extreme importance*), with an additional score of -1 (*opposed to my values*)[4]. The ten basic values were computed as the average score across all the items that comprise each value.

Results and Discussion

We first applied the usual ordinal MDS to generate a 2-dimensional representation of the correlations among the ten values. The obtained configuration has a good fit (*Stress-1*=.13) according to the benchmark criteria of Spence and Ogilvie (1973). The configuration is similar to the one shown in Figure 1, but conformity is located between tradition and security, in line with Schwartz's original (Schwartz, 1992) and recent (Schwartz, 2012b) suggestion. Forcing the points onto a perfect circle using spherical MDS (i.e., the smacofSphere function in smacof; De Leeuw & Mair, 2009) increases the Stress value to .14, suggesting that it is a slightly less accurate spatial representation. Yet on this circle, too, conformity is located between tradition

[4] The asymmetry of the scale reflects the natural distinctions people make among values (Schwartz & Bardi, 2001). Although this asymmetry can be seen as a psychometric weakness, the rating of -1 is used very little (see details in Bardi et al., 2009) and therefore its effect on the findings is probably minimal.

and security. Hence, analyzing the inter-correlations of the ten values replicates the typical finding of a circle of values for this sample.

For unfolding the persons-by-dissimilarities data, smacofRect generated the solution shown in Figure 2. It exhibits the expected circular structure for the values[5]. The person points are shown as transparent grey points, one for each of the 327 persons. All person points are located within the value circle.

The normalized Stress for the solution in Figure 2 is .17. To be able to evaluate this index, we ran two simulations, one with 1000 327 x 10 matrices of random data sampled from a uniform rectangular distribution, and another one with 1000 matrices where the observed dissimilarities were randomly permuted within each row of the data matrix. In the former case, the mean $Stress_n$ value was 0.46 (*SD*=.01). In the latter, more restrictive case, the mean $Stress_n$ value was 0.29 (*SD*=.001). Hence, the Stress value of the configuration in Figure 2 can be considered highly significant.[6]

The ten basic values differ in their contributions to overall Stress (as measured by Stress-per-Point indices). Stimulation, hedonism, and tradition contribute roughly twice as much to the Stress generated by the value points as conformity, universalism, self-direction, and benevolence; power, achievement, and security are in between (see Table 1).

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[5] The dashed circular line in Figure 1 is a least-squares circle fitted to the value points by using an R-function provided by Lavaredo (2012).

[6] Unfolding of random data or of permuted data leads not only to high Stress (i.e., poor fit), but also to solutions that differ substantially from Figure 1. In particular, they do not exhibit the circle of value points at all.

Although all the person points are located within the value circle, most persons are located far from power and tradition. This is in line with the value profile of psychology students in Britain (see Bardi et al., 2014).

For individuals, the alienation coefficients are small in almost every case (see Figure 2, right panel). The mean alienation coefficient across all individuals is .16, with 97% of the coefficients below the 5% quantile of *K* for random dissimilarities. A closer look at the data of the worst-fitting person shows that this person's point lies somewhat to the right of the center of the person points in Figure 2. This person rated hedonism highest (+2.9, centered index score) and stimulation, a value adjacent to hedonism in Figure 1, lowest (-2.8). Because it is impossible to place a person point close to hedonism and far from stimulation, this person does not fit so well into this space.

If we eliminate the five worst-fitting persons from the unfolding analysis, the configuration of value points in Figure 2 (left panel) remains almost unchanged, and the value for $Stress_n$ is reduced only slightly from .174 to .170. Thus, a few outliers do not affect the configuration of value points because it depends on the data from all persons, whereas the location of a person point depends only on the ten dissimilarities of the individual person. Nevertheless, taking a closer look at persons who are not so well represented in the unfolding solution allows identifying how these persons differ from most others.

The results of this study confirm our hypotheses: The 2-dimensional unfolding model describes the data well, with a strong fit. The value points form a circle-like structure, with most points ordered as in typical correlation-based studies using the SVS. For the vast majority of respondents, their own value priorities fit the value circle well. Would we find the same pattern of results using a different value instrument? We test this possibility in the next study.

Study 2

Participants and procedure. This sample includes 69 university students of various subjects and levels in Britain (60% female), aged 18 to 27 (M = 20.99, SD = 1.89). Participants completed a value questionnaire followed by another questionnaire that was not used in the current investigation.

Instrument. The second most used instrument in value research is the Portrait Value Questionnaire (PVQ40; Schwartz et. al, 1999). It consists of 40 items, each a short portrait of one person. Each portrait describes a person's goals, aspirations, and desires that reflect that person's values. Participants rate the extent to which each person portrayed is similar to themselves, using a 6-point response scale from *not like me at all* to *very much like me*. For example, to measure power, the PVQ includes two portraits: "It is important to him to be rich. He wants to have a lot of money and expensive things." and "It is important to him to get respect from others. He wants people to do what he says." The participants' ratings of the similarity of these portraits to themselves are averaged to yield a global power score. Participants complete a version that describes persons of the same gender as theirs.

Results and Discussion

Based on the correlations among the ten values, ordinal MDS generates a 2-dimensional representation with a good fit (*Stress-1*=.09). The configuration shows the usual approximate value circle. Forcing the points onto a perfect circle increases the Stress value only slightly to .10. Hence, this sample also replicates the typical finding of a circle of values based on the inter-correlations among values.

Unfolding the 69 by 10 data matrix in two dimensions yields the configuration in Figure 3. Its normalized Stress is .19 compared with an expected Stress value for random data of .44

(*SD*=.01), and for randomly row-wise permuted data of .26 (*SD*=.004). This is a highly significant fit. The configuration of value points exhibits a circular structure, with values ordered as predicted by the Schwartz (1992) theory. The contributions of the different values to the overall Stress of the unfolding solution are quite similar across values (see Table 1). The dissimilarities of most of the 69 persons are well represented by the unfolding solution (the mean alienation coefficient is .18 (with 96% smaller than the 5% quantile for random data).

The locations of achievement and power are reversed on the circle, as are the locations of hedonism and stimulation. However, these inversions can be considered minor deviations from the theory because they involve a (quantitatively small) interchange of two theoretically adjacent values (see Schwartz, 1992). Future research should investigate how stable and predictable such deviations from the predicted order are, in particular in relatively small samples.

Most important, however, this study reveals that the circle of values is found within individuals even with a different measurement instrument. This study confirmed our expectations using the most typical sample in psychological research – students in a Western country. Would the same pattern of results emerge in a general population sample? Study 3 tests this possibility.

Study 3

Participants and procedure. The data are from the 2012 wave (round 6) of the European Social Survey (ESS), an academically driven cross-national survey conducted every two years across Europe (Jowell, Roberts, Fitzgerald, & Eva, 2007). The ESS obtains random probability samples representative of all persons aged 15 and over who are resident within private households in each country. Here, we investigate the 2261 British residents who provided answers to all the items of the ESS Human Values Scale in face-to-face interviews.

Instrument. The ESS Human Values Scale is an adaptation of the PVQ40 described in Study 2, intended for use in large surveys with limited space (Schwartz, 2003). Also known as the PVQ21, it includes 21 items identical to or modified from those in the PVQ40, and it employs the same instructions and format.

Results and Discussion. An MDS of the inter-correlations of the ten value indices yields an almost perfectly circular value circle in the plane with a low *Stress-1* of .060. Enforcing a perfect circle entails only a very small increment in Stress (.070). The order of the values on the circle corresponds perfectly to the order of the prototypical value circle, with conformity located between tradition and security. Moreover, using spherical MDS, the ten values are distributed evenly around the circle, without clustering. Metric unfolding of the data matrix yields a highly significant (normalized) Stress of .15. The resulting configuration is shown in Figure 4. Again, the value circle emerges clearly. The order of the values on the circle is as expected, except for security (SE) which is located on the other side of tradition (TR) and conformity (CO).

All values contribute about equally to the overall Stress (see Table 1). The unfolding configuration explains almost all individuals well: The mean alienation coefficient over all persons is .14 (with 99% below the 5% quantile for random data). If we split the sample by gender, the male subsample (N=964) yields a value circle with all values ordered as in the Schwartz theory. In the female subsample (N=1267), however, security (SE) is in the position shown in Figure 4. Overall, we can conclude that for this large representative sample, using yet another instrument to measure values, the value circle again emerges as predicted—both in the usual MDS analyses across persons and, importantly, also in the unfolding analysis that represents each individual.

Study 4

This study extends the test of the within-person structure to a new country, the USA. The sample consists of adults from the general population, the instrument is similar to Study 2, and the language still English. Additionally, this study sought to demonstrate the possibility of using unfolding to show graphically how the value profiles (shown as person points) of meaningful sub-groups of participants are distributed within the value circle. This provides a richer picture of sub-sample distributions than simple inferential statistics of differences between groups do. We illustrate this by using sub-groups of males and females because there is established knowledge on how the genders differ on values. Schwartz and Rubel (2005) found that the strongest value difference between men and women in over 100 samples from around the world is that men tend to value power more than women and women tend to value benevolence more than men. We therefore expect to find more men close to power and more women close to benevolence.

Participants, instrument, and procedure. The sample included 151 adults from various states in the USA (58% females), aged 18 to 75 (M = 35.64, SD = 13.00); 32.5% with a first degree at a university, 25.8% with some university studies, 16.6% with a postgraduate degree, and 14.6 % with no more than a high school degree. The annual income of 45.7% of participants was less than $35,000 (in 2012); 53% were single and 36.4% were married or cohabiting; 67.5% had no children and 16.6% had one child. Most participants were White (72.8%). Participants completed the PVQ40 (Schwartz et al., 1999) online as part of a larger study in which they were recruited through online community forums for an $80 prize draw.

Results and Discussion

Based on the correlations among values, ordinal MDS generates a 2-dimensional representation with an excellent fit (*Stress-1*=.05). The configuration is almost perfectly circular. Forcing the points onto a perfect circle increases the Stress only by .007. Hence, this sample also

replicates the typical finding of a circle of values for the inter-correlations among the values. Unfolding the data in two dimensions yields the configuration in Figure 5. Its normalized Stress is .19, highly significant compared with the Stress for random data of .45 (*SD*=.01) and of randomly row-wise permuted data of .30 (*SD*=.002). The configuration of value points exhibits a circular structure, with values ordered as predicted by the Schwartz (1992) theory.

To show the distribution of men's and women's person points in the configuration, the person points are shown as squares for women and filled circles for men. Discriminant analysis shows that these two types of person points can be significantly separated along the line that represents the opposition achievement/power vs. benevolence/universalism (Welsh's t = 4.578; df = 144.765; p = .000), with men nearer power and women nearer benevolence, in line with the gender differences found previously (Schwartz & Rubel, 2005).

The different values contribute largely similarly to the overall Stress (see Table 1). The unfolding solution represents the dissimilarities of almost all 151 persons well (the mean alienation coefficient is .18, with 90% below the 5% quantile for random data). Thus, for most respondents in this study too, their own value priorities fit the value circle quite well. In sum, this study reveals that the circle of values is found within individuals in a sample from a country other than Britain. Yet, the USA and Britain share the same language and have somewhat similar cultures (see Hofstede, 1991; Schwartz, 2006). Our final study asks whether the circle of values within individuals is also found in a sample from a very different culture that speaks a different language.

Study 5

Study 5 samples students in Iran who completed the value questionnaire in their native language, Farsi. Iranian culture emphasizes embeddedness and hierarchy substantially more and

autonomy and egalitarianism substantially less than British and American cultures (Schwartz, 2009), making Iran one of the most collectivistic countries in the world. This is therefore a particularly strong test of the generalizability of the finding of a value circle within individuals.

Participants, instrument, and procedure. The sample included 75 university students in Iran (57.33% females), aged 18 to 29 (M = 20.76, SD = 2.25), who completed the PVQ40 (see Study 2), followed by another questionnaire that was not used in the current investigation.

Results and Discussion

Based on the correlations among the values, ordinal MDS generated a 2-dimensional representation with an acceptably good fit (*Stress-1*=.14). The configuration supports the Schwartz value circle, except that power and achievement are reversed on the circle. Moreover, the circle itself is somewhat dented on the arc between power and stimulation. Yet, forcing the points onto a perfect circle increases the Stress value only slightly to .15. Hence, this sample too, replicates the typical finding of a circle of values using inter-correlations among the values.

Unfolding the 75 by 10 data matrix yields the configuration in Figure 6. Its normalized Stress value is.17, highly significant when compared with the simulated Stress value for random data of .44 (*SD*=.01) and of randomly row-wise permuted data of .21 (*SD*=.003). The configuration of value points exhibits a circular structure, with values largely ordered as predicted by the Schwartz (1992) theory. The only major difference from the theoretical expectation is a reversal of the locations of two theoretically adjacent values, power with achievement, similar to the configuration of this sample based on correlations.

The different values contribute rather similarly to the overall Stress (see Table 1). The dissimilarities of almost all 75 persons are well represented by the overall unfolding solution (the mean alienation coefficient is .16, with 96% below the 5% quantile for random data). Thus, for

almost all respondents in this study, their own value priorities fit the value circle quite well. The distribution of the person points in Figure 6 shows that the person points are distributed primarily along one axis, i.e. along the line connecting power and tradition. This may indicate that for these Iranian students, the trade-off between power and tradition is the dominant conflict, because it is with respect to these two values that we find the greatest variance.

Overall, we find a good fit of the predicted unfolding model even in a sample culturally distant from those in the previous studies. The circle of values is also quite well replicated. This emphasizes the robustness of the circle of values within individuals.

General Discussion

This paper presents the first model that permits testing a key assumption on which the structure of values is based: the circle of value conflicts and compatibilities exists within individuals and not only in analyses across the individuals in a sample. That is, within each individual, if a person prioritizes particular values he or she also tends to prioritize compatible values and to not prioritize opposing values in the circle. The absence of empirical support for this essential feature of values until now was a serious lacuna for confirming a basic assumption of Schwartz's (1992) theory of values and, more generally, for the theoretical understanding of values.

The current findings are strikingly robust: Across samples that vary in measurement instrument, culture, language, and type of population, we found that the structure of a value circle exists within individuals in each sample. Our analyses show that the unfolding model can serve as both an intra- and inter-individual model of value priorities. No correlations are needed, and almost every single individual has his or her place in the shared unfolding configuration. This is a remarkable finding, because the model postulates the same configuration of values (i.e.,

a circle of values with a specific order of values on the circle) for almost every individual. Only the person points can be set person by person. Thus, almost all persons seem to experience the value conflicts and compatibilities in essentially the same way; people differ only in their value priorities. Using this model, deviations of single individuals from the common value structure are easily detected and could be pursued in future research. Systematic differences among sub-samples, such as men and women, are also easily detected because the reliance on a stable basic structure makes deviations more noticeable.

In all five studies, the unfolding solutions exhibit approximate value circles. The order of the values on these circles always closely corresponds to the order predicted by Schwartz (1992, 2012b). The only value that varies in location across different samples is achievement. In Studies 2 and 5, it reverses its position on the circle with power. This variation of achievement values merits further study.

Despite the good fit of the model for almost all individuals in our samples, closer analyses may well detect systematic differences among subgroups within samples. This is what we found, for example, in Study 4. In this study, men and women shared the same value configuration but were significantly separated based on the priorities they attributed to power and benevolence values. Subgroups may differ not only in their priorities but also in their value structures. A more detailed analysis of Study 5, in which we computed separate male and female configurations, not reported above, revealed that hedonism, though not the other values, had different locations in these subgroups.

The effect of gender on the distribution of person points suggests a promising direction for future research. Other types of groups whose value profiles differ may lead to similar or even larger effects. For example, supporters of different political parties (reviewed in Caprara &

Vecchione, 2009) and people in different occupations (Knafo & Sagiv, 2004) each tend to have distinct value profiles. These profiles are likely to manifest as distinguishable areas of person points of an unfolding configuration. Unfolding analyses can be revealing in studying value differences between all sorts of groups (work groups, organizational departments, cultures, ages, etc.). Any continuous variable that relates clearly to values can also be used to split a sample into high and low subgroups. These subgroups could exhibit clear divisions of the distribution of person points on unfolding analyses. This is likely to be the case, for example, for the traits of the Big Five taxonomy that correlate systematically with values (see meta-analyses in Fischer & Boer, in press; Parks-Leduc, Feldman, & Bardi, 2015).

Analysis Variations and their Implications for the Robustness of the Findings

An important methodological issue in unfolding analyses is the choice of the starting configuration (Borg & Groenen, 2005). Different starting configurations can lead to different solutions, because the algorithms that iteratively improve the configuration may get stuck in a local rather than the global minimum of the Stress function. It is therefore important to check whether it matters with which configuration we let the unfolding analyses begin their iterations. In each of our studies, we tested various methods to answer this question such as using random starting configurations or a perfect theory-based value circle—always together with random configurations for the person points. What we found is that all starting configurations led to almost exactly the same final unfolding solution in each study. Hence, the unfolding solutions that we present can be considered to be the robust global optima.

One could also ask what weaker unfolding models would produce. Unfolding is often based on constraints that allow (a) only intra-individual comparability of the rating scores (often called *split-by-rows* conditionality), and (b) optimal re-scalings of the data values by interval or

even ordinal transformations. Naturally, such models greatly reduce the testability of the unfolding theory by introducing many free parameters that are mathematically optimized by the unfolding algorithms without any substantive constraints. Indeed, in case of the given data, each such model will ultimately degenerate unless additional penalty functions are used to avoid such meaningless solutions (Busing, Groenen, and Heiser, 2005). Given a strong, and therefore vulnerable, theory-compatible solution with an excellent fit to the data, there is no need to pursue weaker models. If we nonetheless do so, we find that the ratio-scale level assumption is not crucial. Interval or ordinal unfolding (with penalty functions to avoid degeneracies) lead to results similar to our metric unfolding even when using row-conditional models that allow a separate regression function for each single individual.

Our findings suggest a relationship of correlation-based MDS and unfolding: Would an unfolding model where all ten values are on a perfect circle, and all person points are on the inside of this circle, also generate a circle of values when using the usual across-person inter-correlations of values as data in an MDS analysis? To answer this question, we ran a simulation study where we randomly located 100 person points on the inside of a unit disk, and randomly positioned ten value points on the rim of this disk. We then computed the distances from each person point to all value points and correlated these distances across persons. Using this 10 x 10 correlation matrix in ordinary MDS perfectly recovered the configuration of value points on the rim of the unit disk, with zero Stress. Hence, the more complex and more explicit unfolding model seems to imply the value circle model generated by traditional research where individuals disappear in the correlations. This finding deserves further methodological research.

Theoretical Implications and Future Directions

Implications for adjustment and well-being. Observing the distributions of person points in the figures, it is possible to see that there is greater density of person points in the middle of the space. Person points become gradually less dense the greater the distance from the center. This indicates that as in a normal distribution, most people are in the middle of the distribution. That is, most people's profiles of values show roughly similar distances from each of the values, with a little more distance from power and tradition in the Western samples. Only a small percentage of people have sharply different preferences among the values. This may be an adaptive tendency: It may be easier to function if one does not have very strong preferences because one will then face fewer life situations that strongly threaten one's values and create emotional turmoil.

The current findings may also shed light on previous weak findings regarding the relations between values and well-being (e.g., Buchanan & Bardi, in press; Oishi, Diener, Suh, & Lucas, 1999). One basis for the circular order of values in the theory is the assumption that people come to avoid prioritizing conflicting values because doing so is likely to lead to repeated internal conflicts (Schwartz, 1992). This theoretical assumption has led many researchers to hypothesize that people who prioritize conflicting values have lower well-being. However, many attempts to test this hypothesis have failed to support it, so the hypothesis and the research that tested it have never been published. The current findings may explain the failure of this hypothesis. It may be due to the fact that very few people give high priority to opposing values from opposite sides of the circle. There may therefore have been too few people who hold conflicting values with sufficiently high importance to provide the statistical power to test the hypothesis. To reveal this fact, an analysis that examines the individual rather than samples was required, such as the unfolding analysis presented here.

Implications for the foundations of values. The finding that values are organized according to the theoretical circle of values for almost all persons in each of our diverse samples is striking. It is highly unusual in social/personality psychology to find that a phenomenon exists for almost all participants; researchers are often happy with explaining less than 15% of the variance. The strength and robustness of this phenomenon points to the possibility that values may be based more on biological foundations than commonly believed. Our findings provide no proof for the existence of biological foundations of values. Yet, explanations grounded in temperament, personality, or social experience would imply greater variation in the value structure across individuals. Such explanations seem more appropriate for explaining individual differences in value priorities. Our conjecture about the biological foundations of the value structure converges with the findings of recent twin studies that identify a genetic component in some values (Knafo & Spinath, 2011; Schermer, Vernon, Maio, & Jang, 2011).

Findings from experimental general psychology regarding color perception (Ekman, 1954), emotions (Schlosberg, 1954), and the interpretation of facial expressions (Takehara, 2008) suggest how biological factors may give rise to circular structures. For example, with regard to color perception, the psychological similarity of color patches that differ in their hues (but have equal saturation and brightness) can be modeled as if the individuals compute distances for color points on a circle. The circle arises because the similarity judgments are generated by three color receptors in the human retina (red, yellow, blue). Secondary colors (green, orange, purple) are perceived as colors in between, although they are simply additive combinations of discrete primary colors. Analogous arguments can be formulated for the psychology of emotions or for facial expressions, i.e., that there is a small set of discrete receptor-like elements that are wired in certain ways and that all have upper/lower bounds in their output functions. Since

values are such fundamental guides of human behavior, there may also be a small set of basic sensors that generate all other values as finite-sum combinations. One possibility is the four higher-order values (e.g., Conservation) shown in the corners of Figure 1.

In conclusion, this paper provides the first complete evidence for an argument that serves as the basis for the structure of values – that almost each individual's value priorities are organized according to the Schwartz value circle (1992). Futhermore, the analytical approach in this paper opens up a multitude of possibilities for future research.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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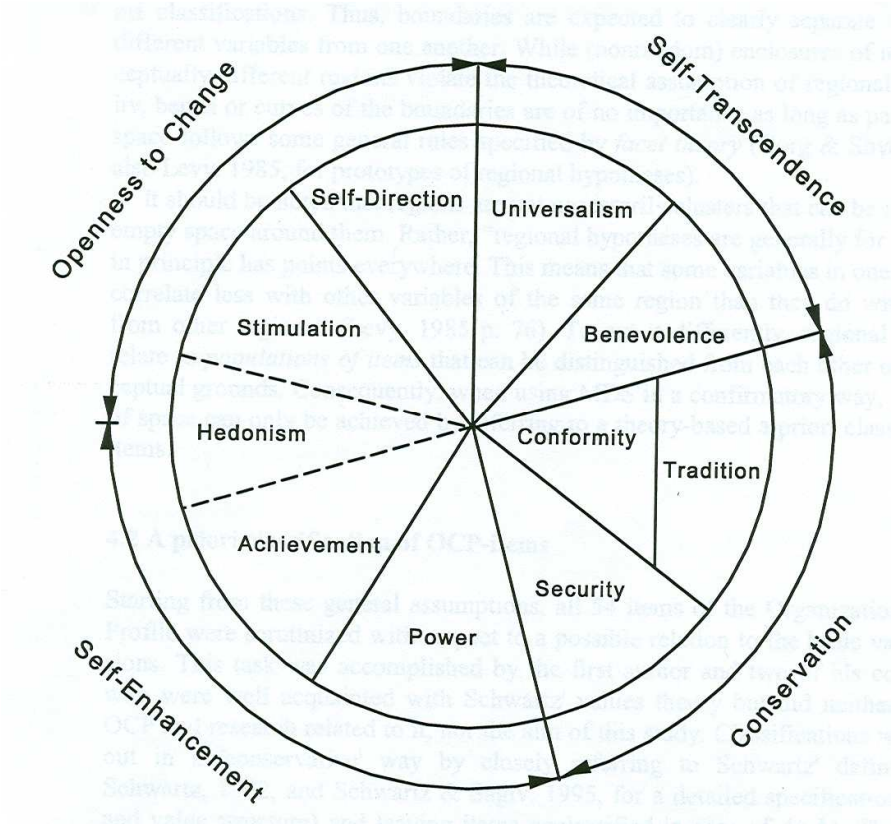

Figure 1. The Schwartz circle of value regions.

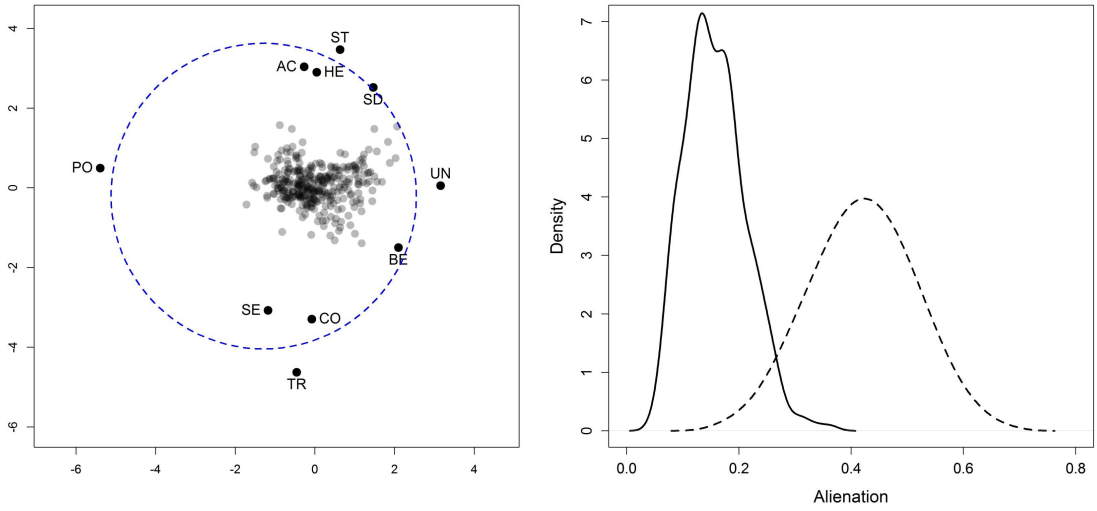

Figure 2. Left panel: Unfolding solution for 327 British psychology students in Study 1 (Stress=.17). PO = Power, AC = Achievement, HE = Hedonism, ST = Stimulation, SD = Self-Direction, UN = Universalism, BE = Benevolence, TR = Tradition, CO = Conformity, SE = Security. Right panel: Density plots of alienations of the 327 students' data vs. the corresponding unfolding distances (solid), and of random data vs. unfolding distances (dashed).

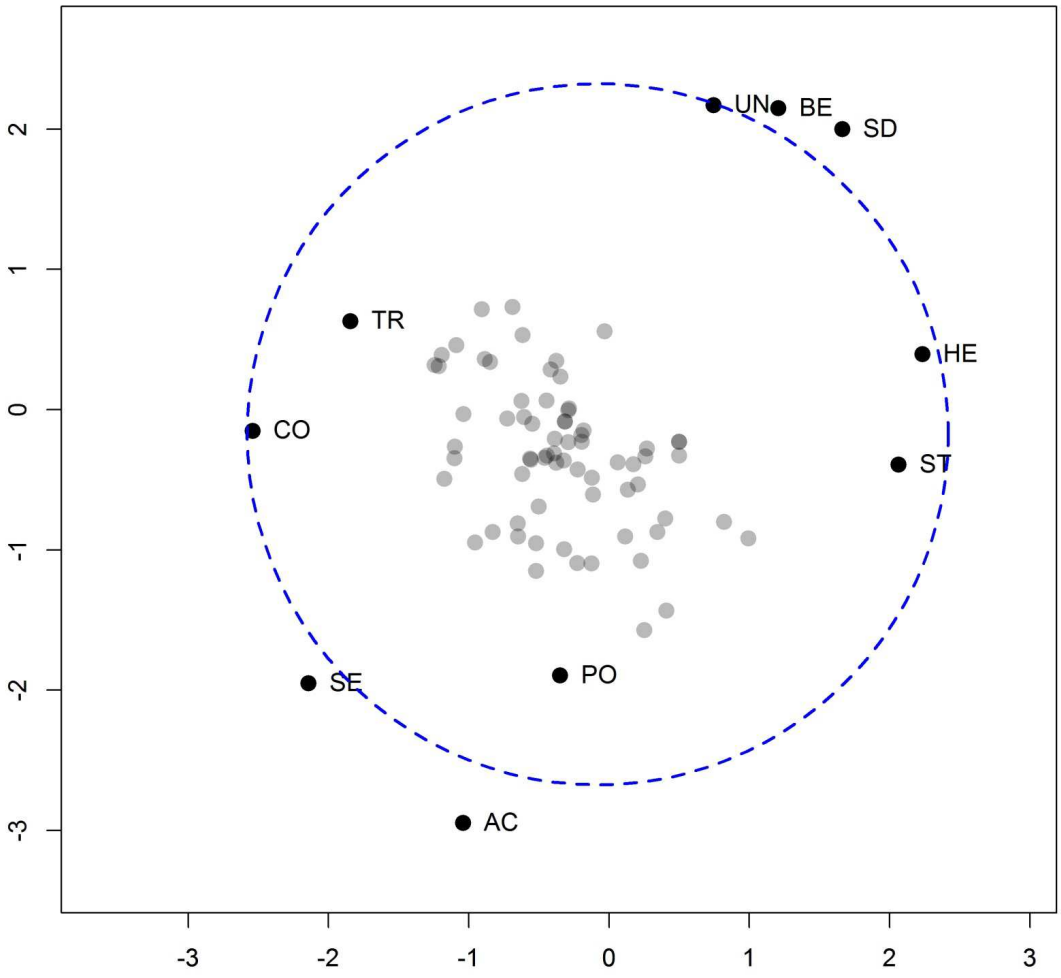

Figure 3. Unfolding solution for 69 British students of Study 2 (Stress=.19).

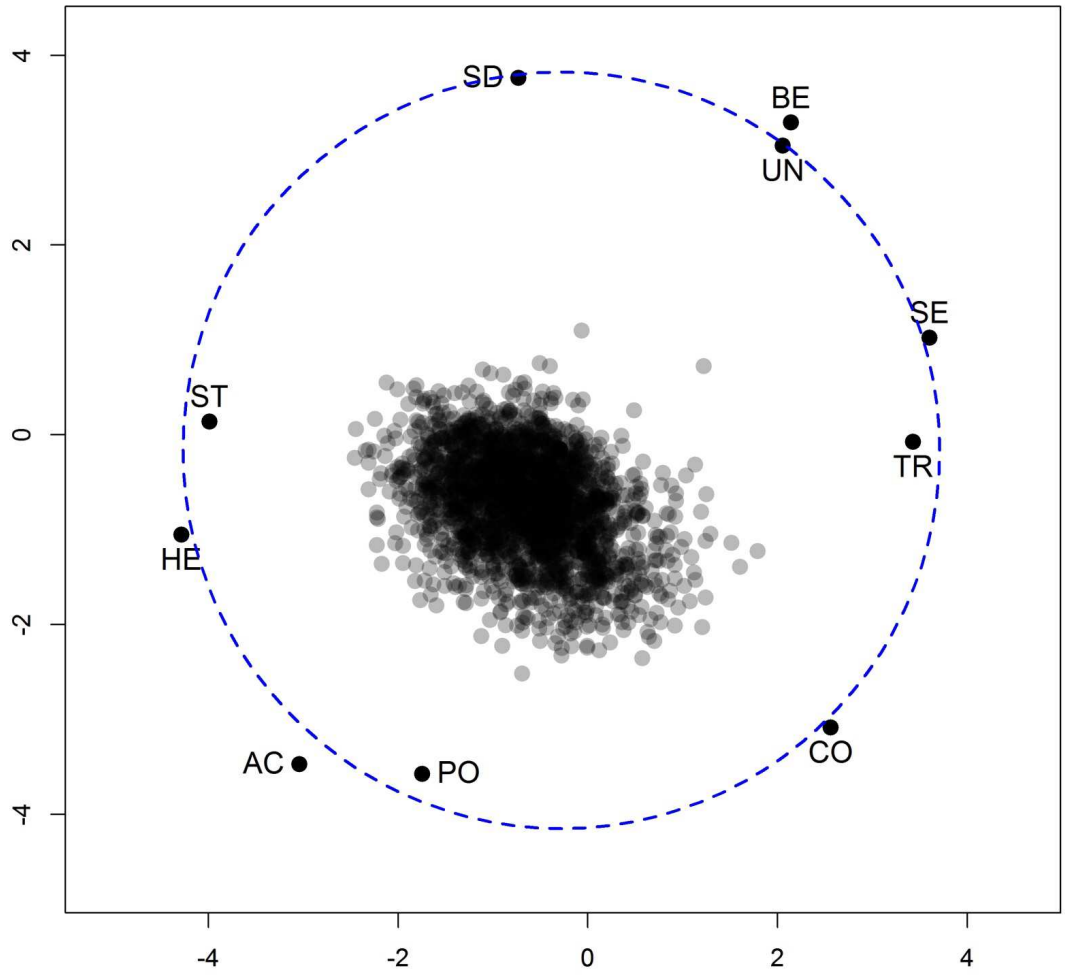

Figure 4. Unfolding solution for 2261 persons of British ESS sample of Study 3 (Stress=.15).

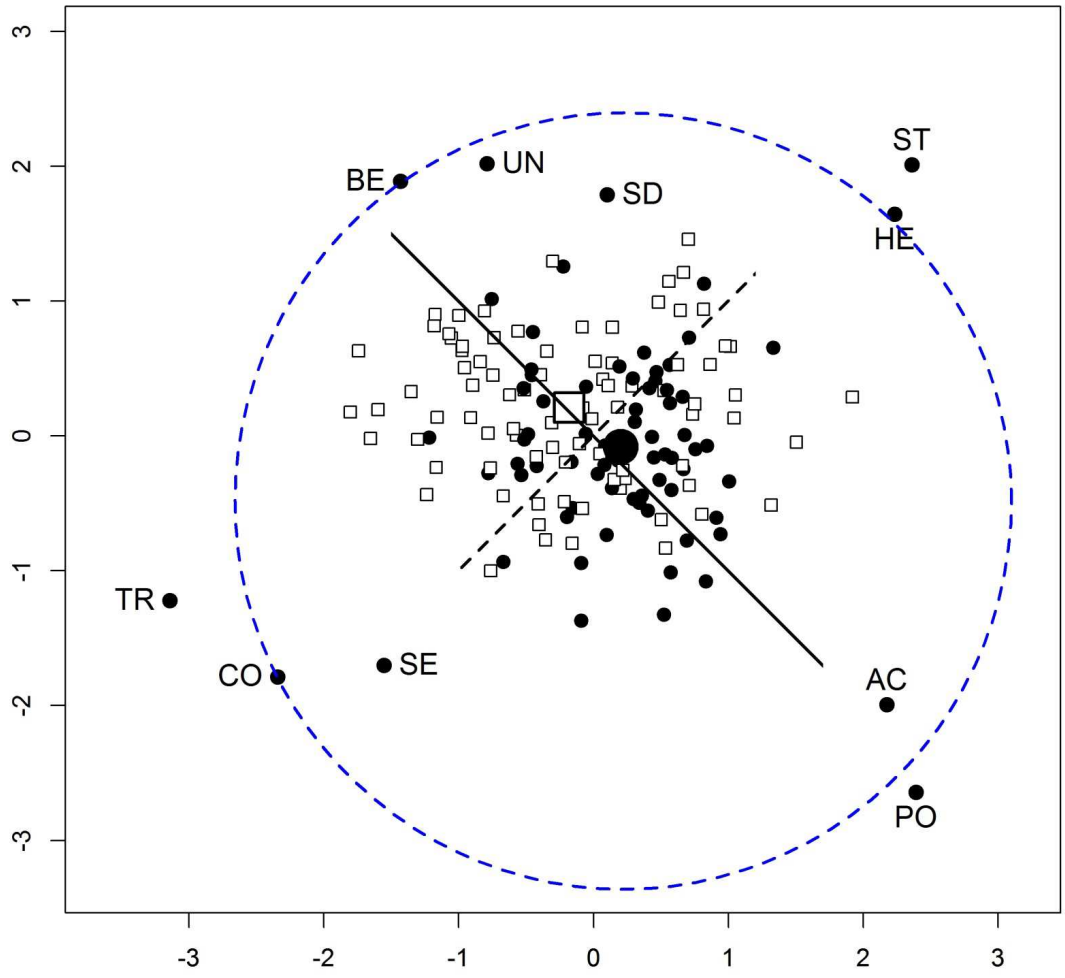

Figure 5. Unfolding solution for 151 Americans of Study 4 (Stress=.19); squares are women, dots are men; large square (dot) is centroid of women (men); solid line is the linear discriminant on which the sub-samples are best separated.

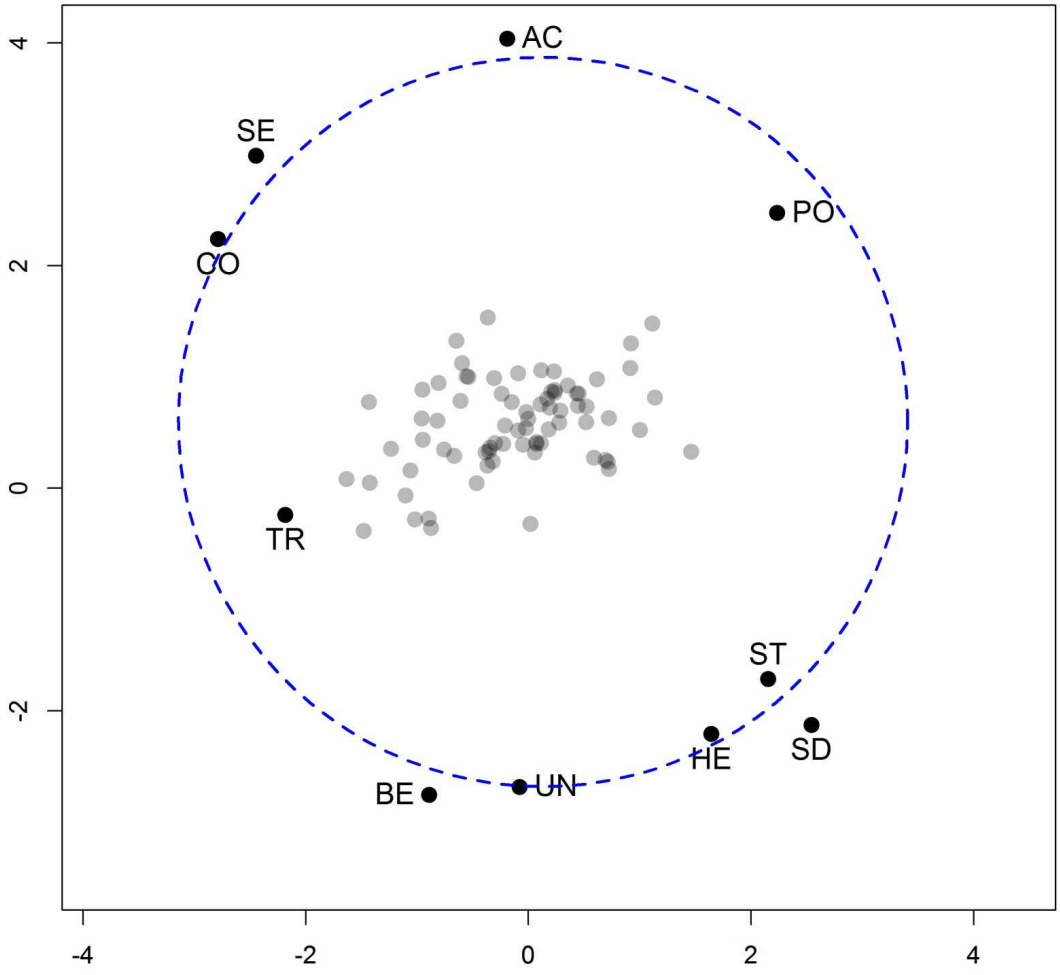

Figure 6. Unfolding solution for 75 students in Iran, Study 5 (Stress=.17).

Table 1

Contribution Percentage of each Value to the Total Stress Generated by All Value Points in the Unfolding Solutions (Stress-per-Point, SPP)

	Study 1	Study 2	Study 3	Study 4	Study 5
Power	10.2	10.2	11.5	10.7	10.4
Achievement	9.8	5.7	8.6	13.1	10.4
Hedonism	15.1	17.7	10.8	11.5	11.9
Stimulation	15.6	13.2	7.3	10.7	9.7
Self-Direction	6.6	8.4	5.8	6.7	10.7
Universalism	7.1	10.8	9.2	9.1	7.2
Benevolence	6.3	10.8	10.3	8.7	9.1
Tradition	13.2	8.7	13.0	11.5	8.5
Conformity	7.3	6.3	13.1	8.7	9.7
Security	8.8	8.4	10.3	9.1	12.3